

General Requirements

- MIL specifications and protocol
- Fault code handling
- Monitoring conditions
- Other terminology/structure



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Malfunction Indicator Light (MIL) Specifications

- Dedicated, single lamp for all OBD faults
 - ISO engine symbol
 - Without text
 - Consistent with NHTSA proposal
- MIL cannot be used for other purposes
 - e.g., maintenance, non-emission faults...



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MIL and Fault Code Logic

- OBD requires statistical fault detection
 - first fault detection sets a pending code
 - fault detection on two consecutive driving cycles requires confirmed (active) code and MIL on
- MIL extinguished when:
 - three consecutive driving cycles occur with no fault detected (monitor runs and passes); or
 - scan tool used to clear codes
- Confirmed (previously active) codes:
 - stay in memory for 40 warm-up cycles after MIL extinguished



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Permanent Fault Code Logic

- “Permanent” code stored in NVRAM for:
 - Any confirmed (active) code currently commanding MIL on
- “Permanent” code erased when:
 - MIL is extinguished by the OBD system (e.g., when the active code changes to a previously active).
 - Cannot be erased by scan tool or battery disconnect
- Helpful feature for roadside/fleet self-inspections
 - Easy to identify vehicles with faults that have not been verified as repaired



Driving Cycle Definition

- Basic Definition:
 - Engine start, monitor runs once, engine shut-off
- Heavy-duty has unique operator habits
 - Engine may be running on a single start for hours, days, or even weeks at a time
- Alternate definition needed:
 - Monitors required to run only “once-per-driving cycle” would be re-enabled after four hours of continuous engine on operation



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Monitoring Conditions

- Manufacturer-defined for each monitor
 - Must be technically necessary for robust monitoring
 - Must be broad enough to allow frequent in-use operation
- Manufacturer also defines fault mature time (how long a condition has to be present to be called a fault)
 - Again, must be limited to technically necessary for robust monitoring and allow frequent monitoring



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Monitoring Frequency

- System must log in-use frequency of several monitors (“rate-based” or “in-use performance”)
 - Provides objective criteria to determine if a monitor runs “frequently” in-use.
- Only required for the major monitors
 - catalyst, PM filter, adsorber, EGR, exhaust gas sensor, boost pressure



Monitoring Frequency (cont)

- Requires on-board computer to keep a count of how often each major monitor has run and could have detected a fault
 - The “numerator”
- Requires a separate counter to record how often the vehicle has been operated
 - The “denominator”
- Ratio of the two gives an indication of in-use frequency



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Monitoring Frequency (cont)

- No minimum required ratio in 2010-2012 MY
- Minimum ratio of 0.100 required for 2013+ MY
 - Number will be modified as necessary after more in-use data are gathered



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Malfunction Thresholds

- The level of deterioration or malfunction that needs to be detected
- Defined by an emission level for several major monitors
 - e.g., deteriorated to the point that tailpipe emissions reach a certain level
- Defined by other criteria for most monitors
 - e.g., at control limits, out-of-range



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Emission Thresholds

- Calibrated one fault at a time
 - Start with an engine with properly working emission controls
 - Representative of end of useful life
 - Determine which test cycle will hit emission threshold first
 - Use engineering analysis or run one FTP and one ESC test with a malfunction to see which is higher
 - Implant progressively worse faults of a single component (e.g., increased plugging of EGR system) on the one test cycle



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Emission Thresholds (cont'd)

- Goal: Every engine variant has properly calibrated emission threshold monitors
 - Like tailpipe standards, OBD monitors should be calibrated to the right threshold on every engine
- Interim Step: Reduce workload and in-use liability for not getting it right the first time
 - Calibrate a representative engine variant to meet the emission thresholds
 - Use engineering judgment to carry-over the malfunction thresholds to other similar variants



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